Sample Questions – June 2014 Final Exam

1) Which of the following is true for locating sounds in the vertical plane?

a) Sound location involves the processing of the interaural time delay.
b) The location of sound sources requires the comparison of sounds reaching the two ears.
c) Sound is located as a function of the processing of the interaural intensity difference.
d) Locating sounds is dependent upon the pinna of the ear.
e) All of the above.

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2) The auditory receptors cells which convert mechanical energy in a change in membrane polarization are located in the organ of Corti. What is the critical event within this structure which mediates the transduction of sound into a neural signal?

a) The displacement of endolymph within the scala vestibuili.
b) The displacement of perilymph within the scala media.
c) The bending of stereocilia.
d) The continual push-pull motion of Reissner's membrane caused by sound.
e) None of the above

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3) Information about touch or vibration of the skin, excluding somatic sensations of the face, takes a path to the brain that is entirely distinct from that taken by other sensory information. What is the pathway serving touch called?

a) The spinothalamic pathway
b) The superior olivary nucleus - inferior colliculus pathway
c) The trigeminal touch pathway
d) The dorsal column-medial lemniscal pathway.
e) None of the above

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4) Which collections of neurons, of the diffuse modulatory system, appear to be involved in the control of sleep-wake cycles, as well as the different stages of sleep, and have been implicated in the control of mood and certain types of emotional behavior?

a) The Serotonergic neurons of the Raphe Nuclei
b) The Dopaminergic neurons of the Substantia Nigra and Ventral Tegmental Area
c) The Noradrenergic neurons of the Locus Coeruleus
d) The Cholinergic neurons of the Basal Forebrain and Brain Stem Complexes

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5) As sleep cycles progress over the course of an average night, the amount of time spent in REM sleep _____ and NonREM _____.

a) Increases; remains the same
b) Decreases; increases
c) Remains the same; decreases
d) Increases; decreases
e) None of the above

Short Answer Questions

1) Describe the physical basis of muscular contraction.

2) The receptive fields of neurons in layer 4C of the striate cortex are similar to the magnocellular and parvocellular LGN neurons providing their input. Specifically, they are generally small monocular center-surround receptive fields. Outside layer 4C, new receptive field characteristics, not observed in the retina or LGN are found. List and briefly describe 3 of these new receptive field characteristics.

Answers

Answers:

1) D
2) C
3) D
4) A
5) D

Short Answer Questions

ANSWERS:

1) 3) The synapse between the terminal button (axon terminal) of an efferent neuron and the membrane of a muscle fiber is called the neuromuscular junctions. The terminal buttons of the neurons synapse on motor endplates, located in groves along the surface of the muscle fibers.

When an axon fires:

1) acetylcholine is liberated by the terminal buttons and produces a depolarization of the post synaptic membrane

2) - an endplate potential id produced (due to the influx of Na+ and the efflux of K+). The endplate potential is much larger than an excitatory postsynaptic potential in synapses between neurons; an endplate potential always cause the muscle fiber to fire, propagating the potential along its length.

*2) [**Binocularity** Microelectrode recordings indicate that most neurons in layers superficial to the 4C are binocular, responding to light in either eye (they have binocular receptive fields). Thus, they actually have two receptive fields, one for each eye.*

Orientation Selectivity *Outside the 4C cells are encountered that respond best to an elongated bar of light moving across their receptive fields. Additionally, the orientation of the bar is critical. In these cells, the greatest response is obtained with a bar with a particular orientation. Orientation-selective neurons are thought to be specialized for the analysis of object shape.*

Direction Selectivity *Many V1 receptive fields exhibit direction selectivity. Specifically, they respond when a bar of light at the optimal orientation moves perpendicular in one direction but not the other.*

Simple and complex receptive fields *The simple cell receptive fields in the primary visual cortex are thought to be the result of the convergence of several adjacent receptive fields of cells in the relay that precedes it in the lateral geniculate nucleus. Note, by the way, that the receptive fields of this nucleus are still circular, like those of its source, the ganglion neurons in the retina. The segregation of on and off regions is a defining property of simple cell receptive fields.*

Other orientation selective neurons in the V1 do not have distinct ON and OFF regions and are therefore not considered simple cells. These are referred to as complex cells. Complex cells give ON and OFF responses to stimuli throughout the receptive field.

Blob receptive fields *Most blob cells are wavelength sensitive and monocular and they lack orientation and direction sensitivity. They receive input directly from the koniocellular layers of the LGN and magnocellular and parvocellular input via layer 4c. Significantly, the blobs contain the great majority of color sensitive neurons outside layer IVc.]*